

Juvenile Salmon Telemetry Studies in the Delta

Dave Vogel, Natural Resource Scientists, Inc.



Juvenile Salmon Telemetry Studies - Past 10 Years



3 MOKELUMNE STUDIES

3 DELTA CROSS CHANNEL STUDIES

2 NORTH DELTA STUDIES

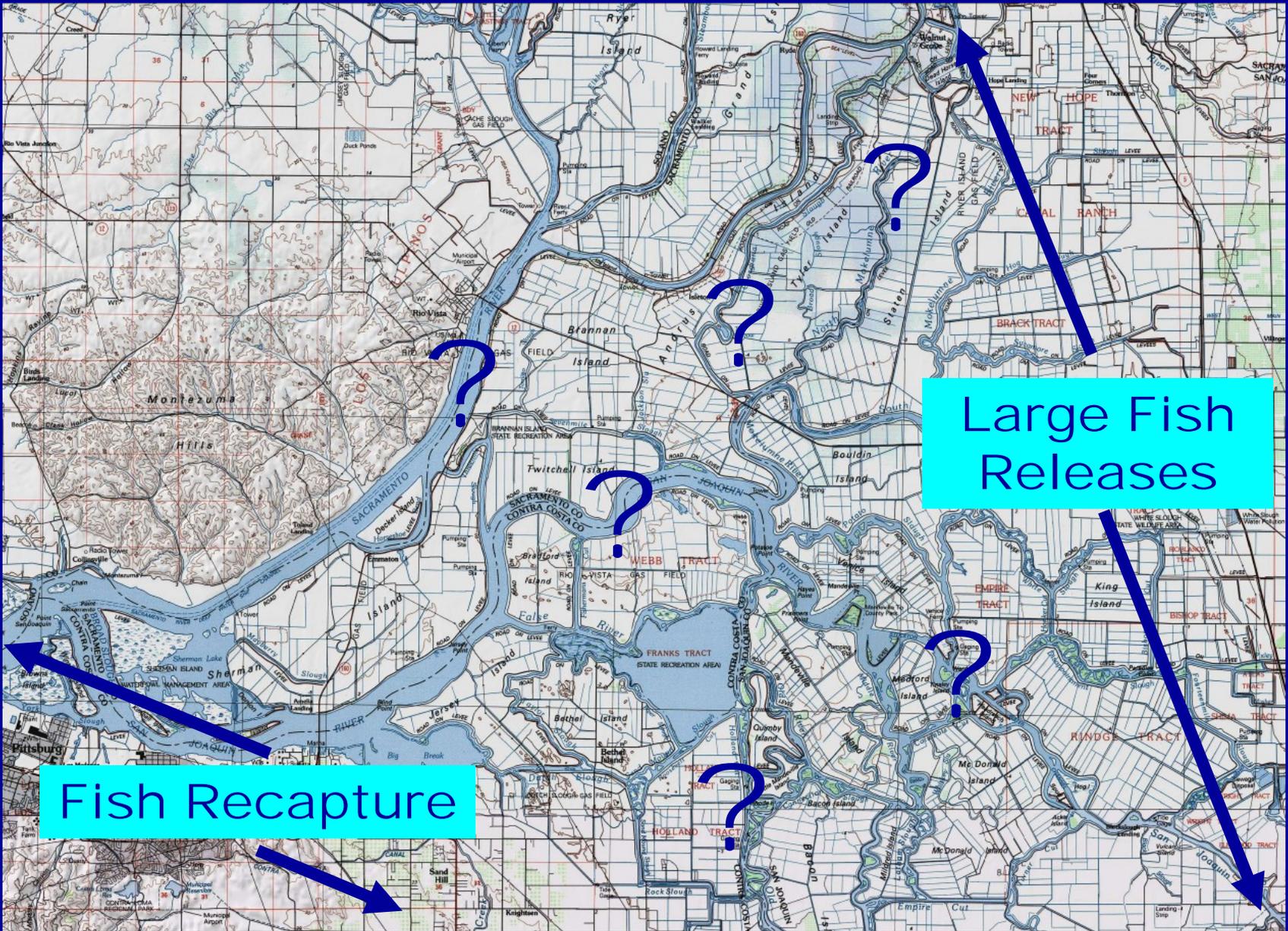
2 CENTRAL DELTA STUDIES

1 SOUTH DELTA STUDY

Juvenile Salmon Telemetry Studies

For investigations on juvenile salmon mortality, radio telemetry has been a valuable tool to provide detailed information on fish survival using far fewer fish than more traditional mass marking programs that have become restricted due to endangered species considerations. (Skalski et al. 2001)

Survival estimates using radio-tagged Chinook salmon can produce accurate, precise, and unbiased results with relatively small sample sizes as compared to evaluations based on coded-wire tagged or PIT-tagged salmon. (Hockersmith et al. 2003)



Large Fish Releases

Fish Recapture

Traditional CWT Juvenile Salmon Studies

**Recovery information for coded-wire tagged Chinook salmon
released during the 2004 VAMP study (SJRGGA 2005).**

Release Site in the San Joaquin River	Number of Tagged Salmon Released	Number of Tagged Salmon Recovered at Antioch	Number of Tagged Salmon Recovered at Chippis Island
Durham Ferry	23,440	1	0
Durham Ferry	21,714	1	1
Durham Ferry	23,327	0	1
Durham Ferry	23,783	0	1
Mossdale	25,320	1	0
Mossdale	23,586	0	1
Mossdale	24,803	0	2

Objectives

- Principal focus on young-of-the-year salmon (100 mm +/- FL)
- Migration pathways
- Multiple reach-specific fish mortality (survival)
- Point-source mortality locations ("hot spots")
- Differential fish migration rates (large- and small-scale)
- Fish behavior and mortality compared to local hydrodynamic conditions (flow splits)
- Fish behavior and mortality compared to representative seasonal hydrodynamic conditions

Radio Tag (Radio Transmission)

1.0-gram



0.75-gram



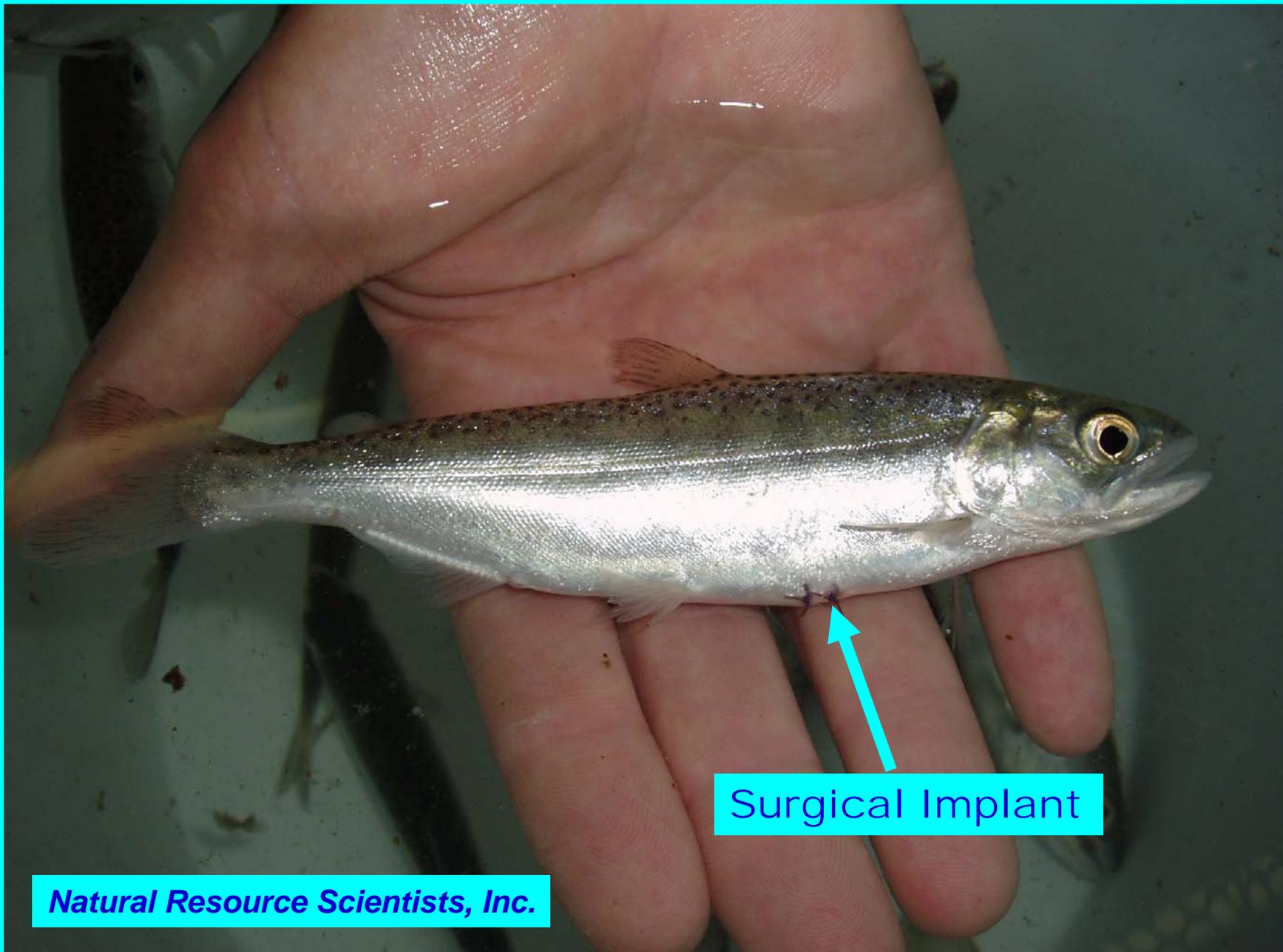
Acoustic Tag (Sonic Transmission)



Two New Miniature Telemetry Tags
Surgically Implanted in Juvenile Salmon



Acoustic Telemetry

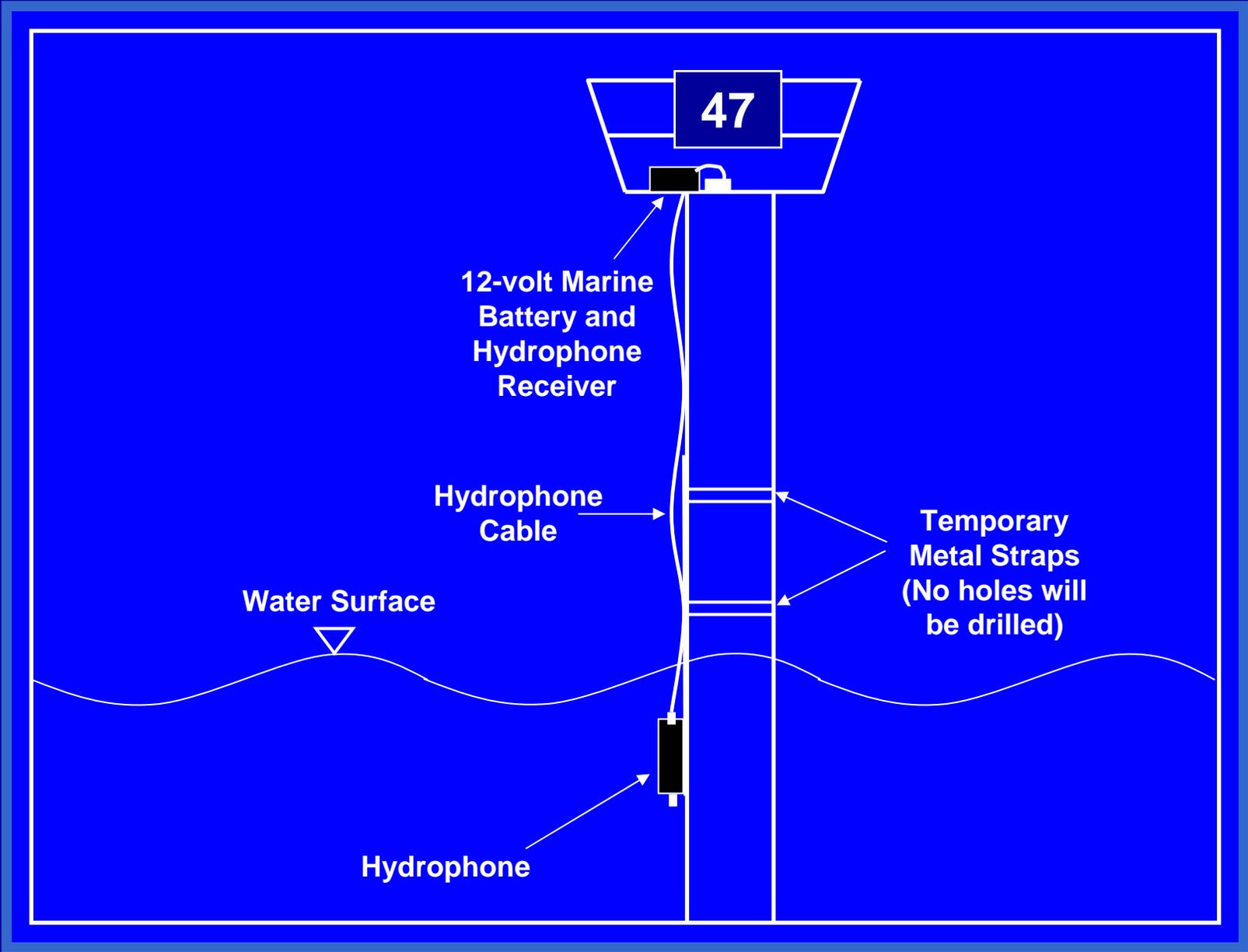


Surgical Implant

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Strategic Locations of Proposed Fish Telemetry Data Loggers



47

12-volt Marine
Battery and
Hydrophone
Receiver

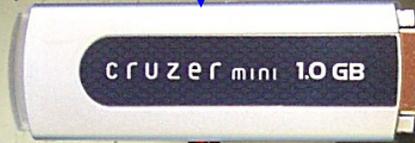
Hydrophone
Cable

Water Surface

Temporary
Metal Straps
(No holes will
be drilled)

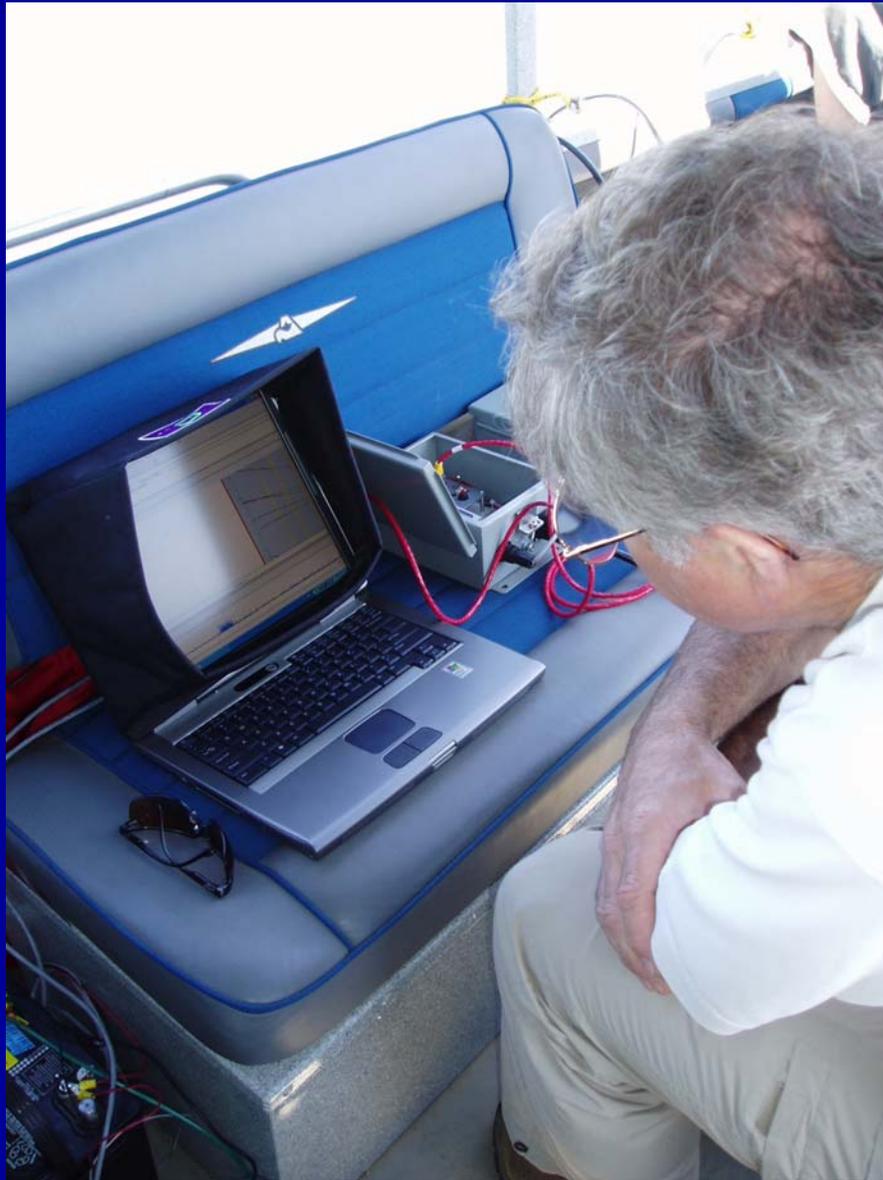
Hydrophone

USB Drive



Network Cable





Real Time
Display of
Telemetry Data

Successful Field Tests in “Noisy” Environments

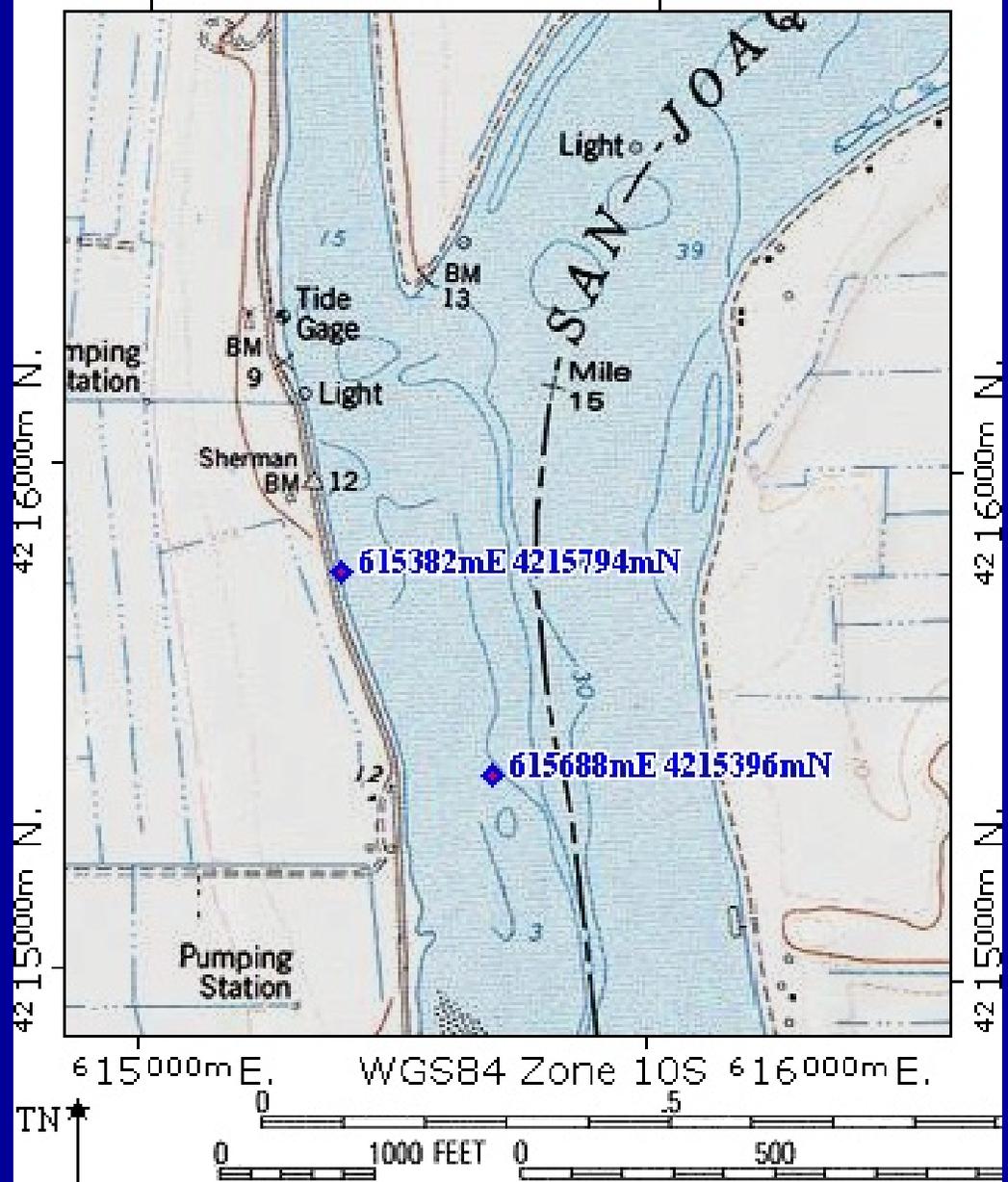


Delta Cross
Channel

Three-Mile
Slough



Printed on 06/05/05 from "California.tpo" and "Ur
615000m E. WGS84 Zone 10S 616000m E.



One-Half Kilometer Range Tests

Initial Field Tests

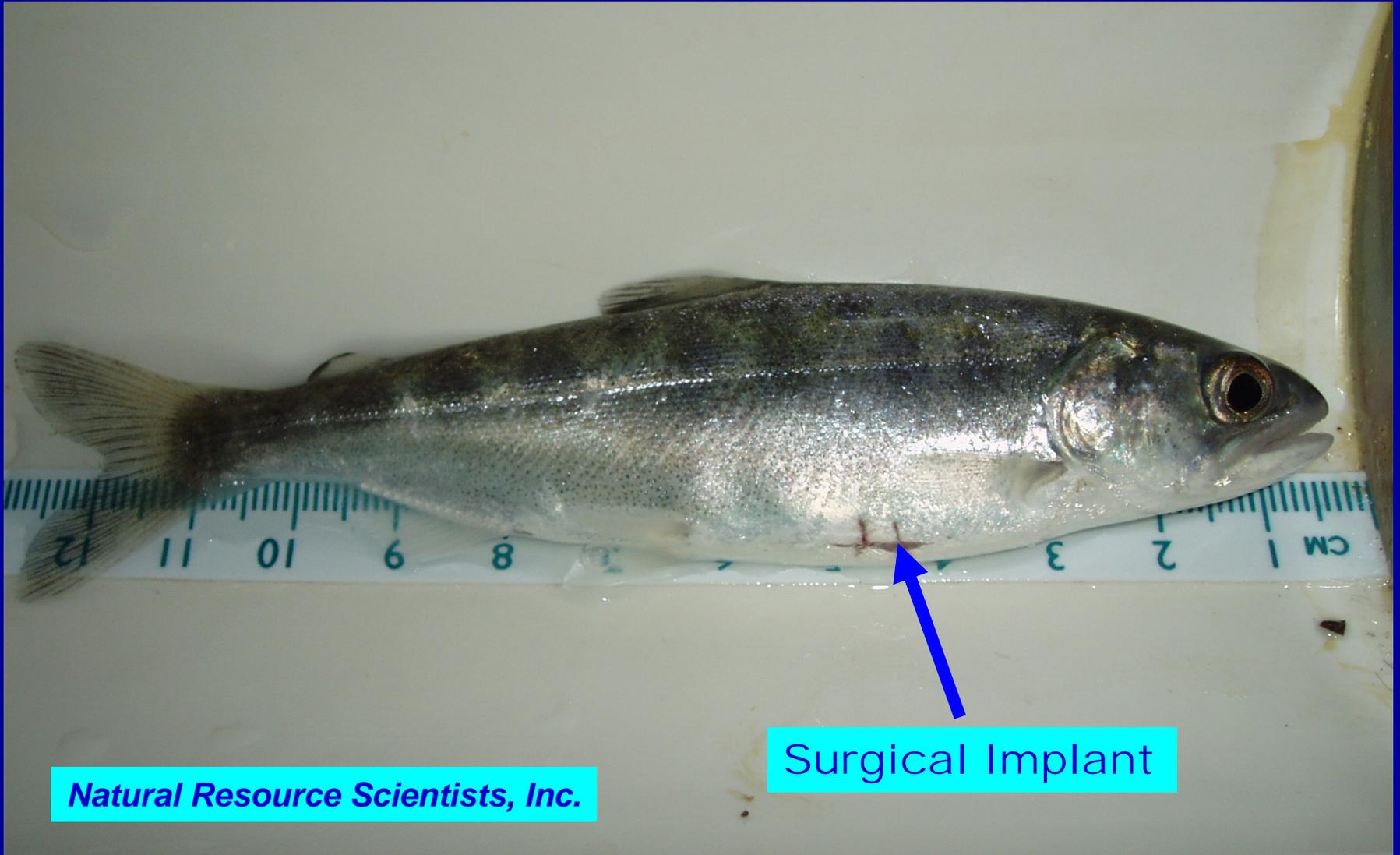


In-Situ Tag Programming Tests



In-situ fish tag programmer allows fish to recover from surgery, extends tag life, and provides flexibility for field logistics

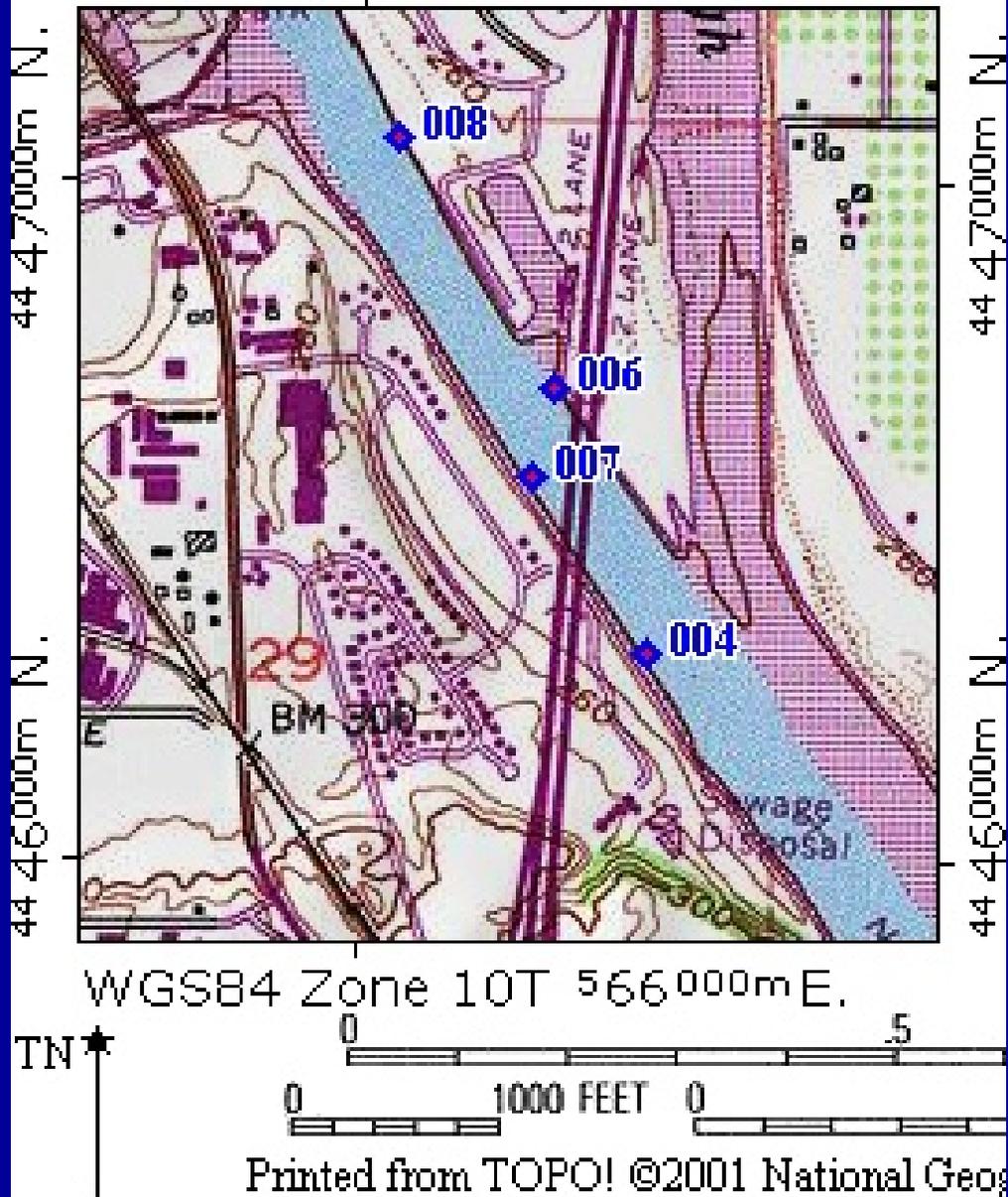
Surgical technique has been perfected
for fish as small as 94 mm FL



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Surgical Implant

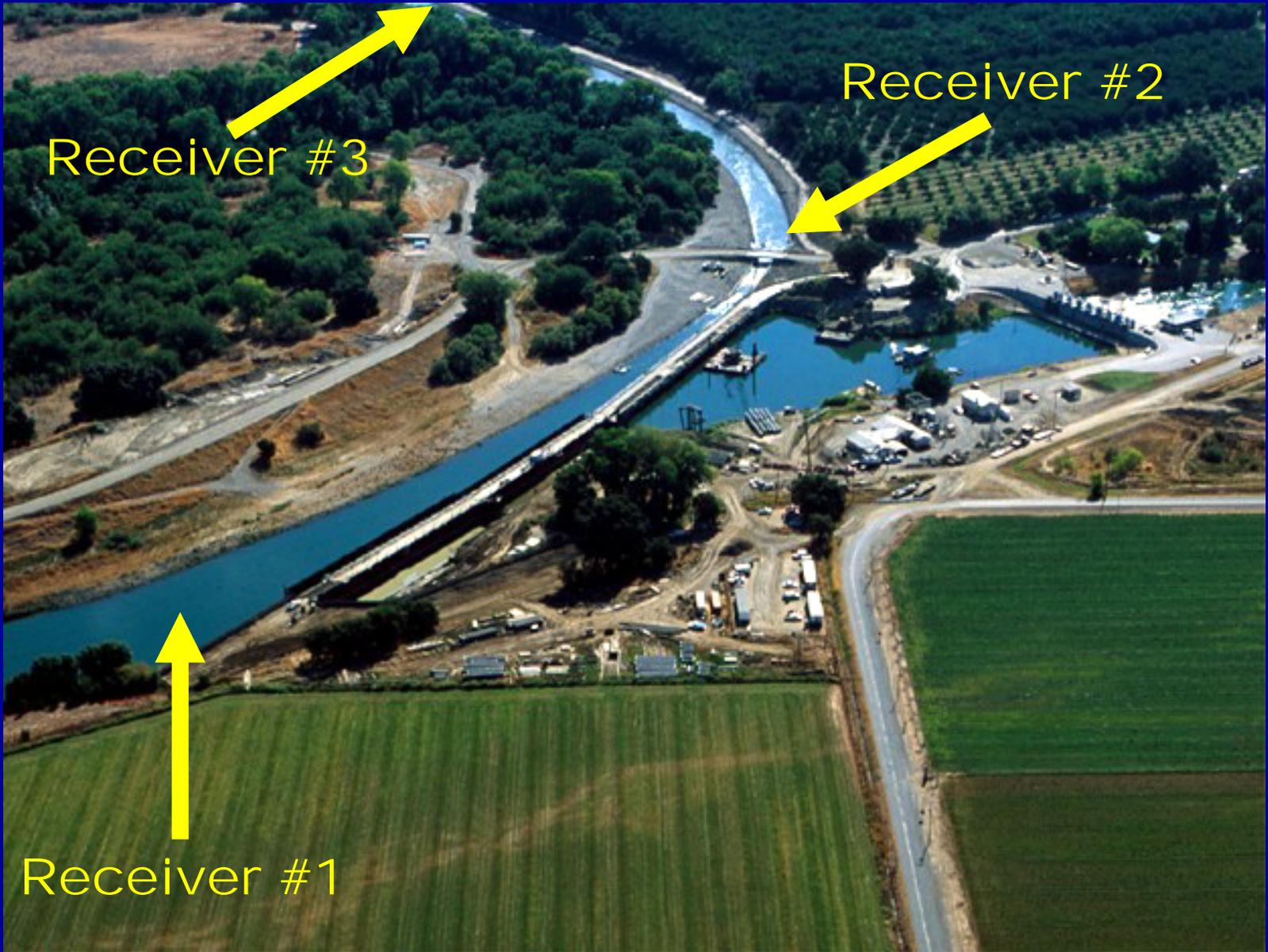
ed on 06/16/05 from "California.tpo" a
WGS84 Zone 10T 566 000m E.



Live Fish and Multiple Receivers Tests

Sacramento River and GCID Fish Screen





Receiver #3

Receiver #2

Receiver #1

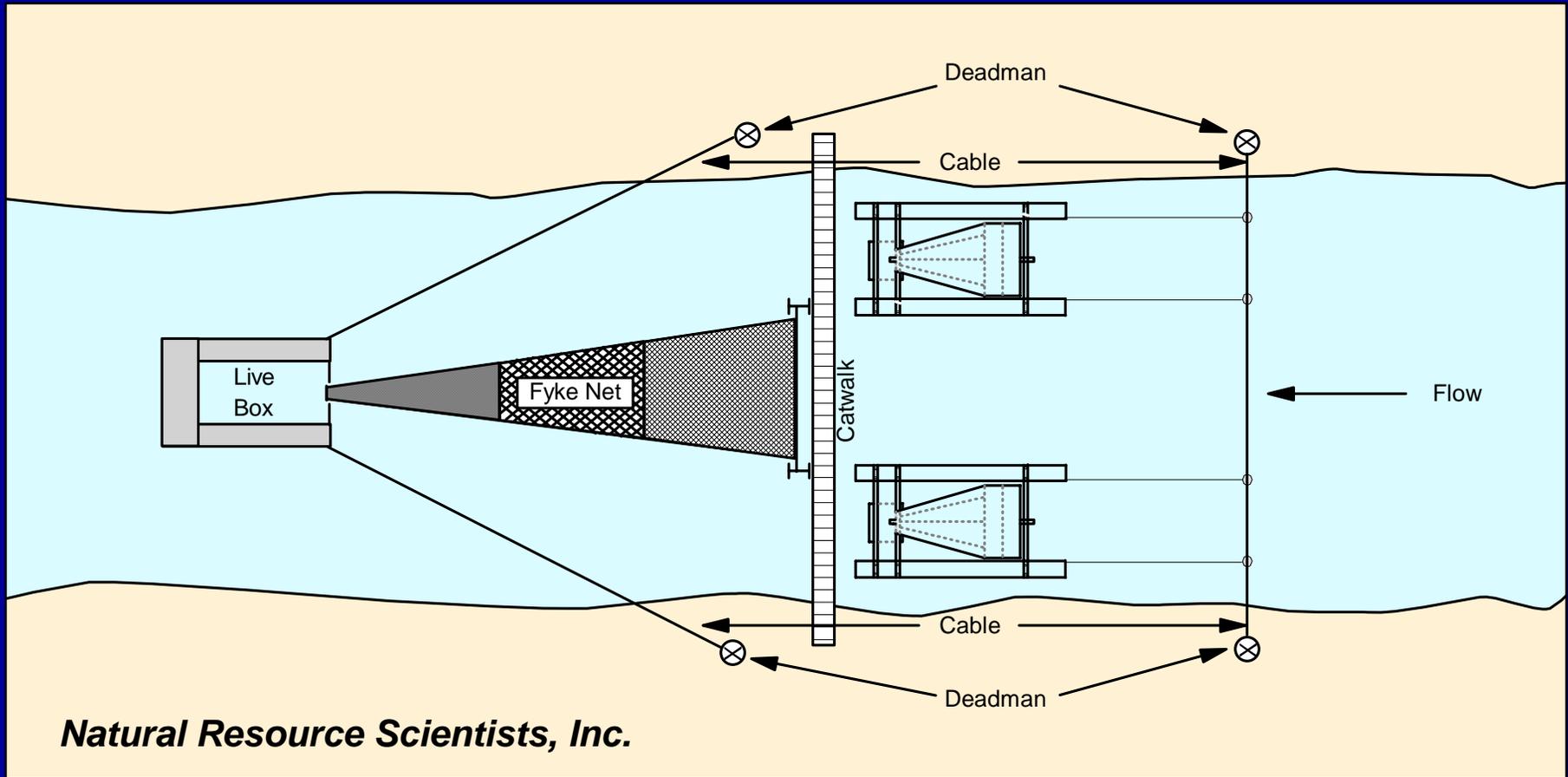


Flow-Control Weir

Fish Recapture Equipment

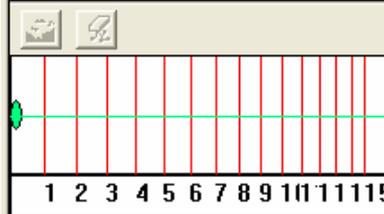
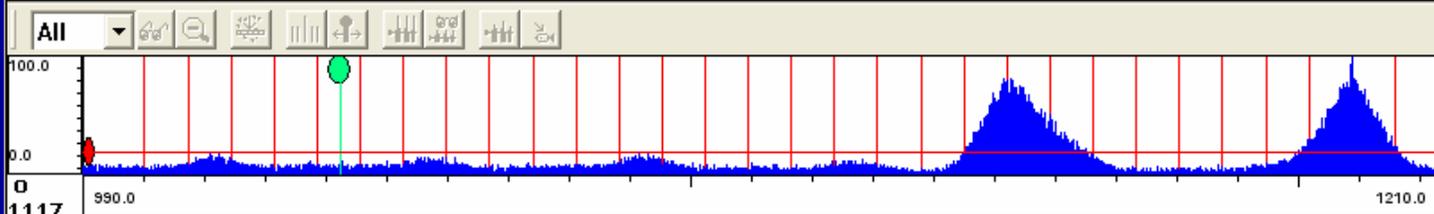
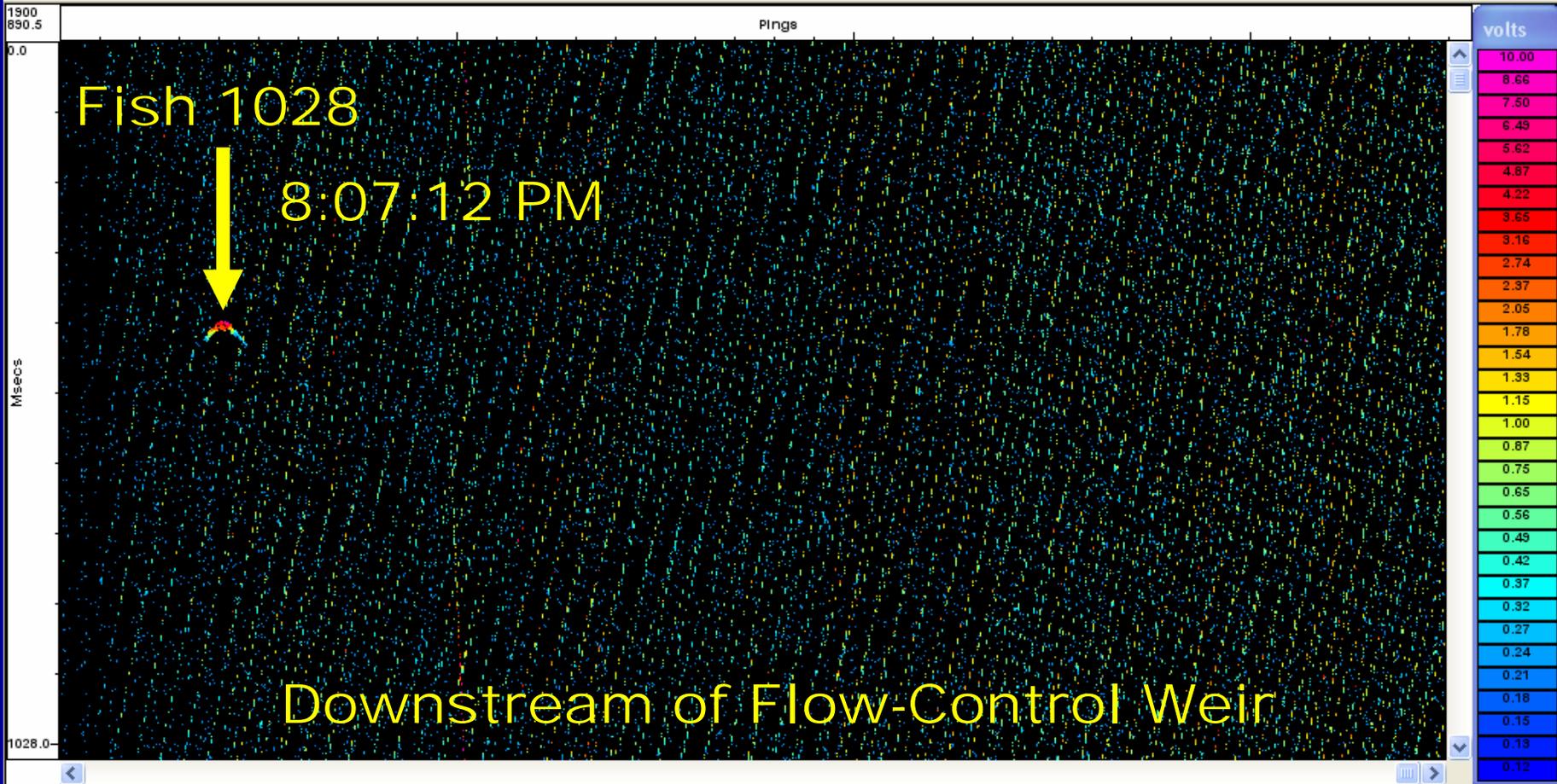


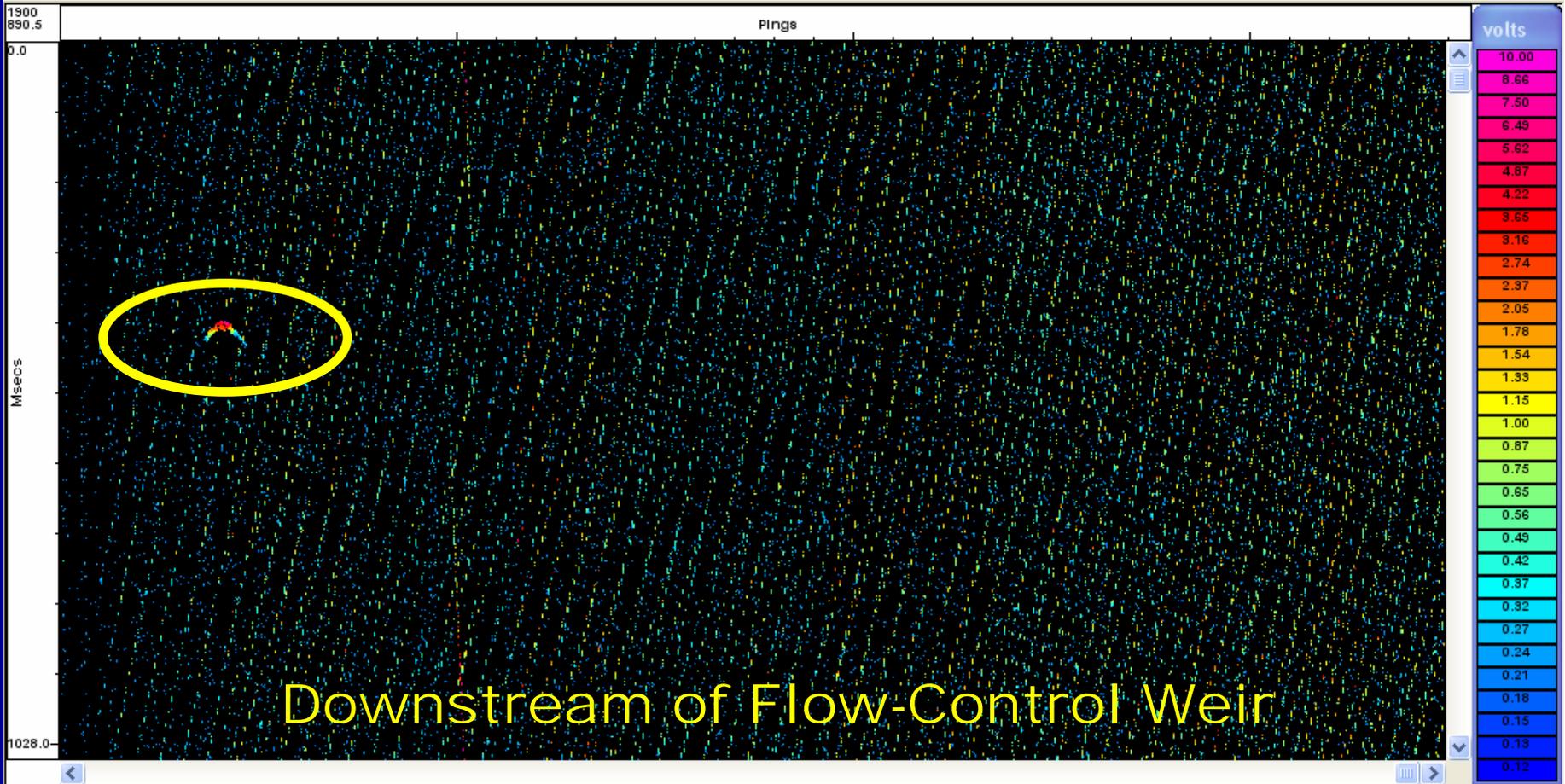
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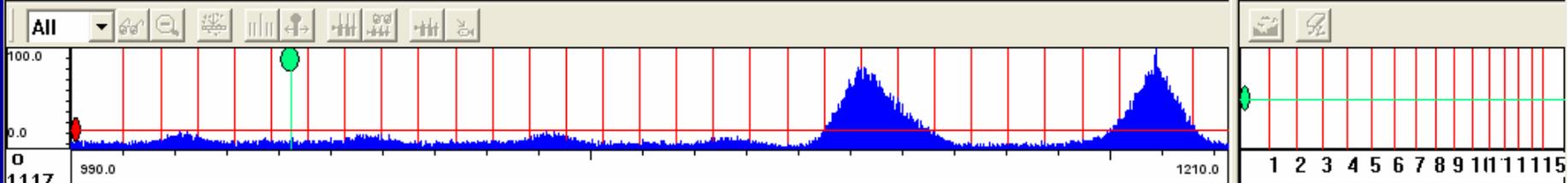
Natural Resource Scientists, Inc.

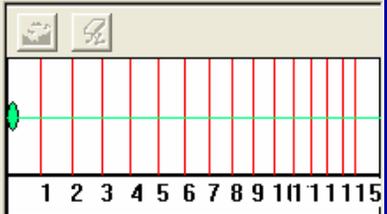
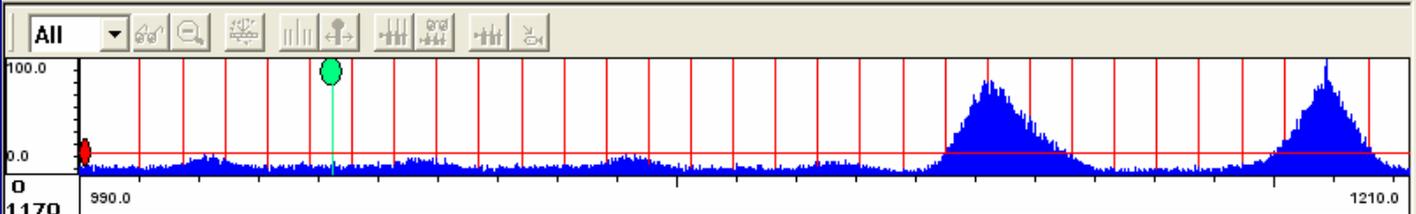
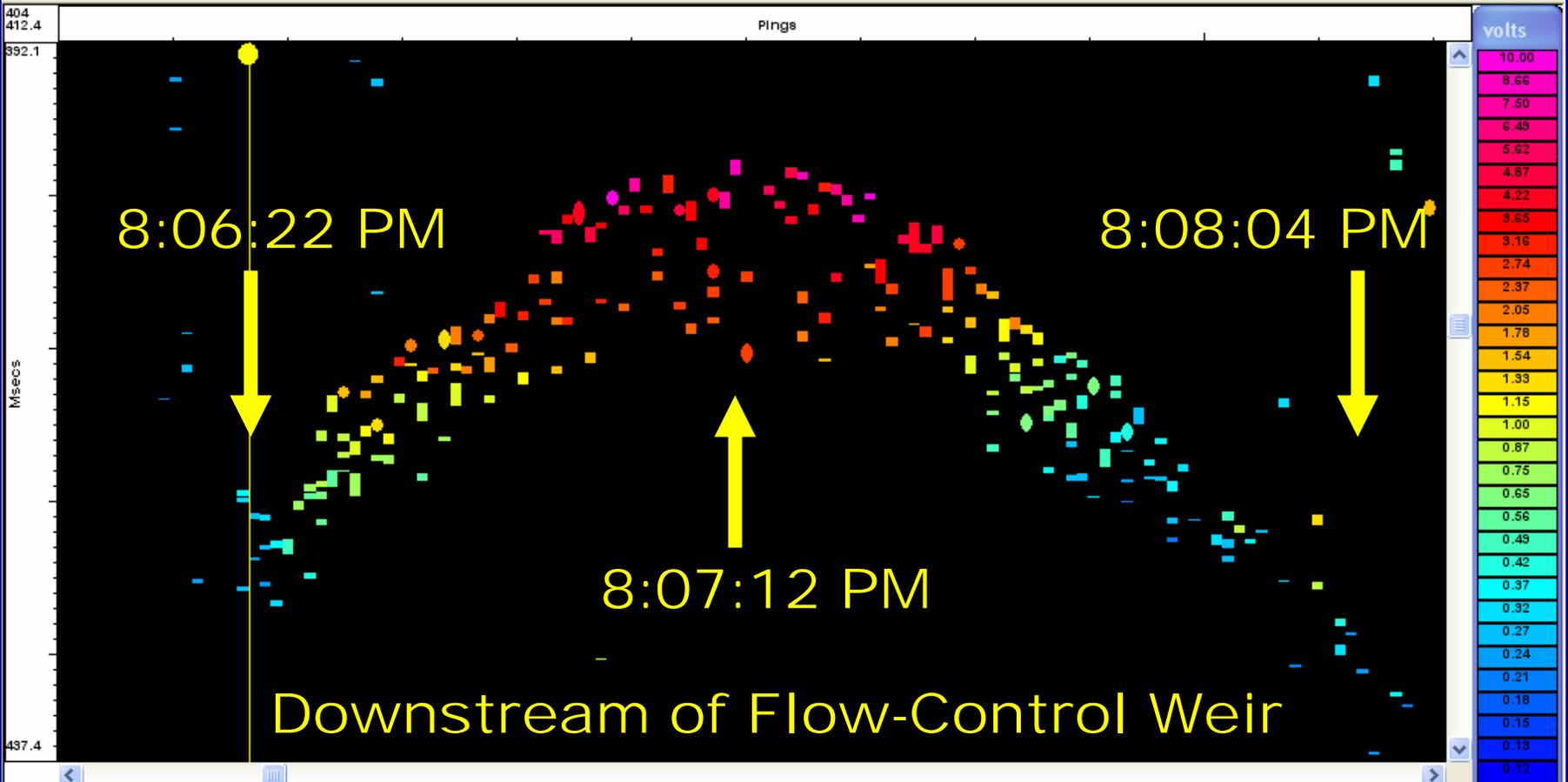
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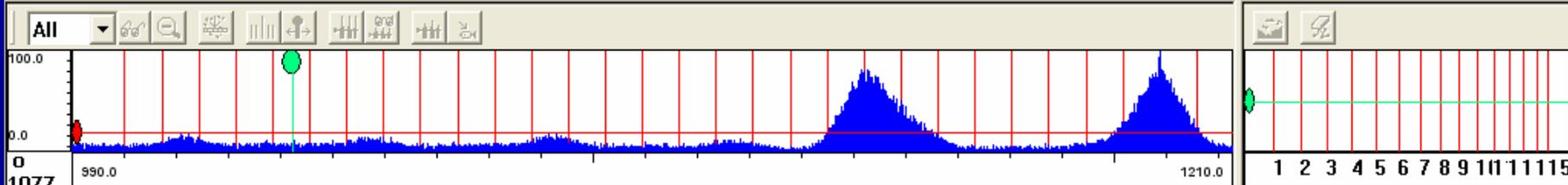
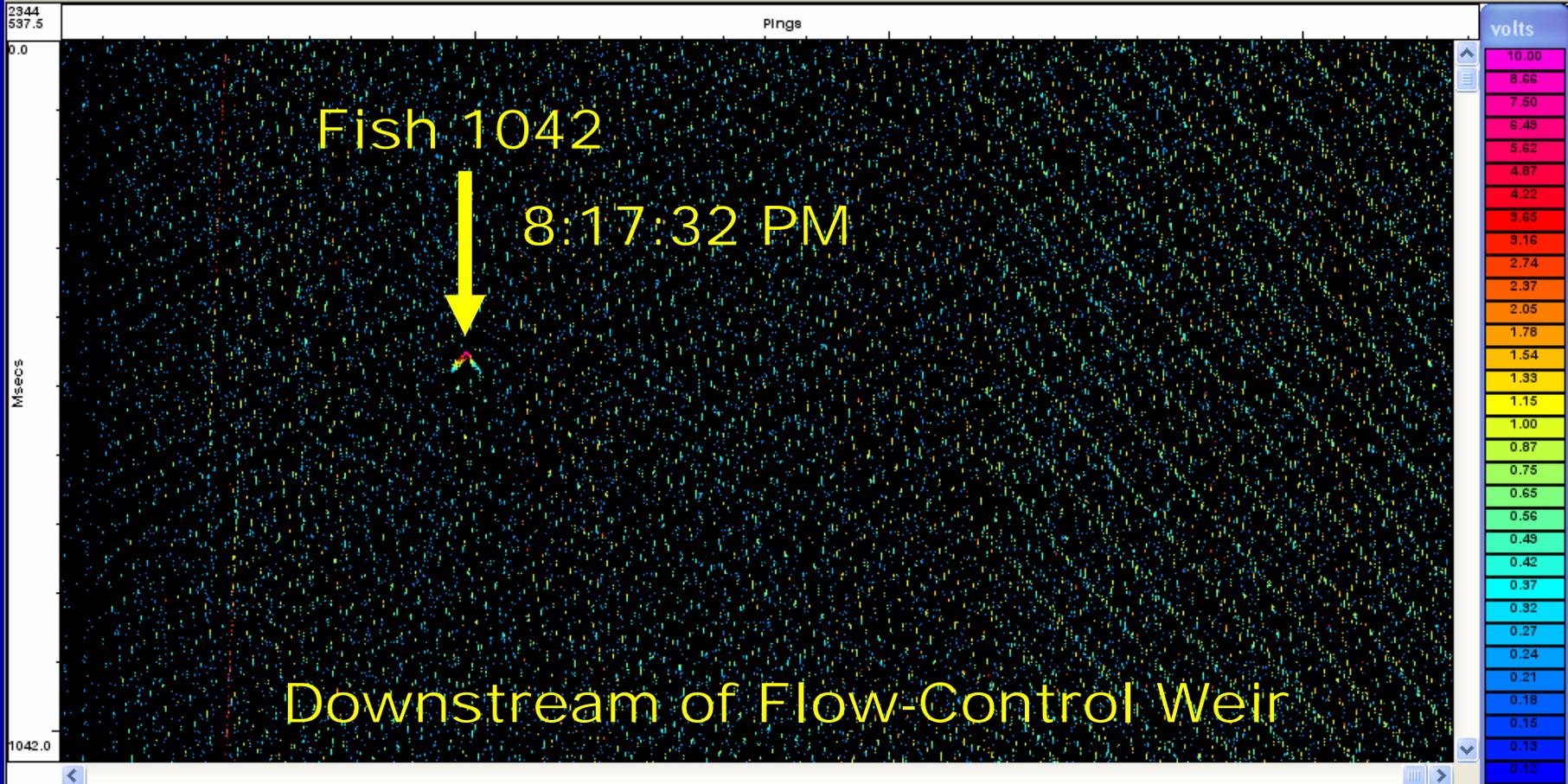




Downstream of Flow-Control Weir





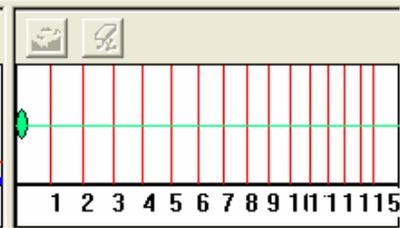
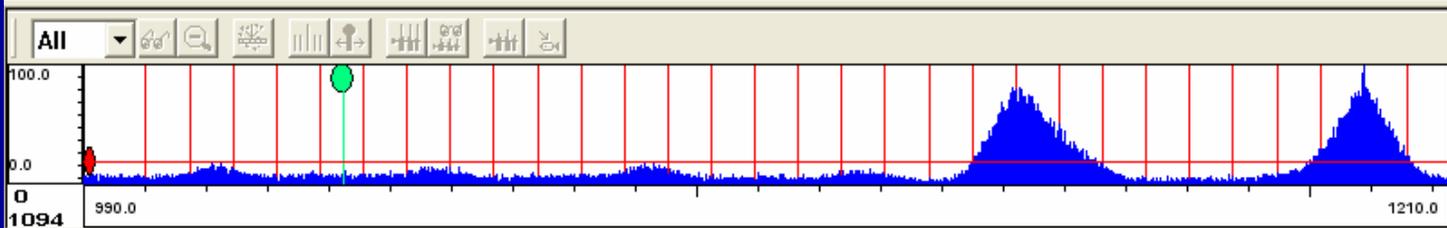
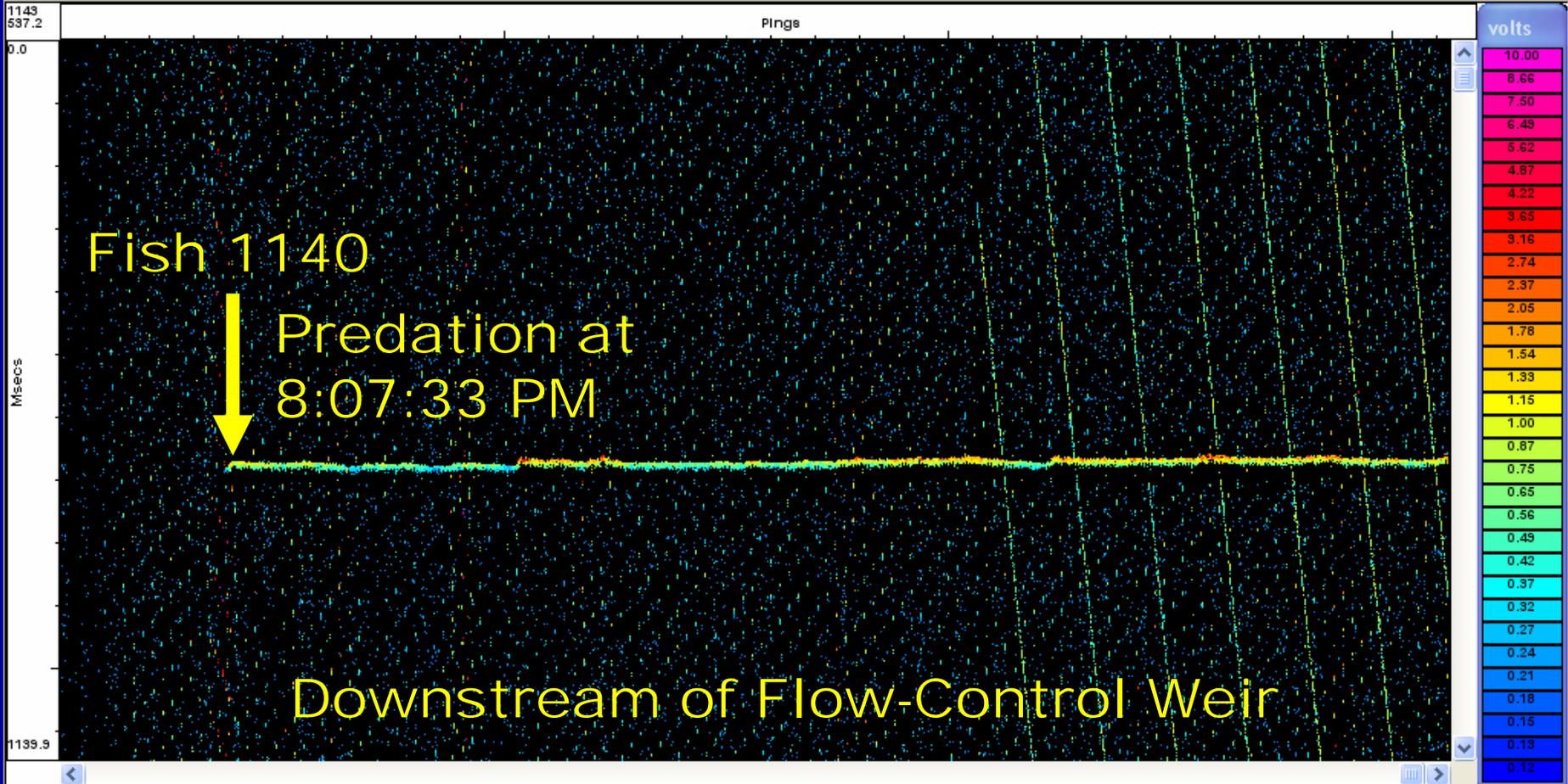


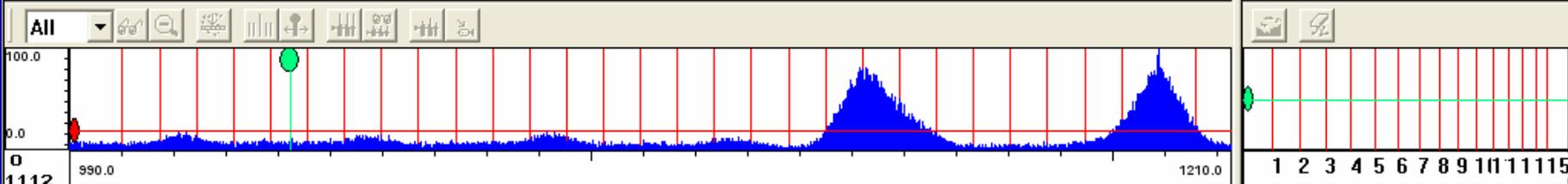
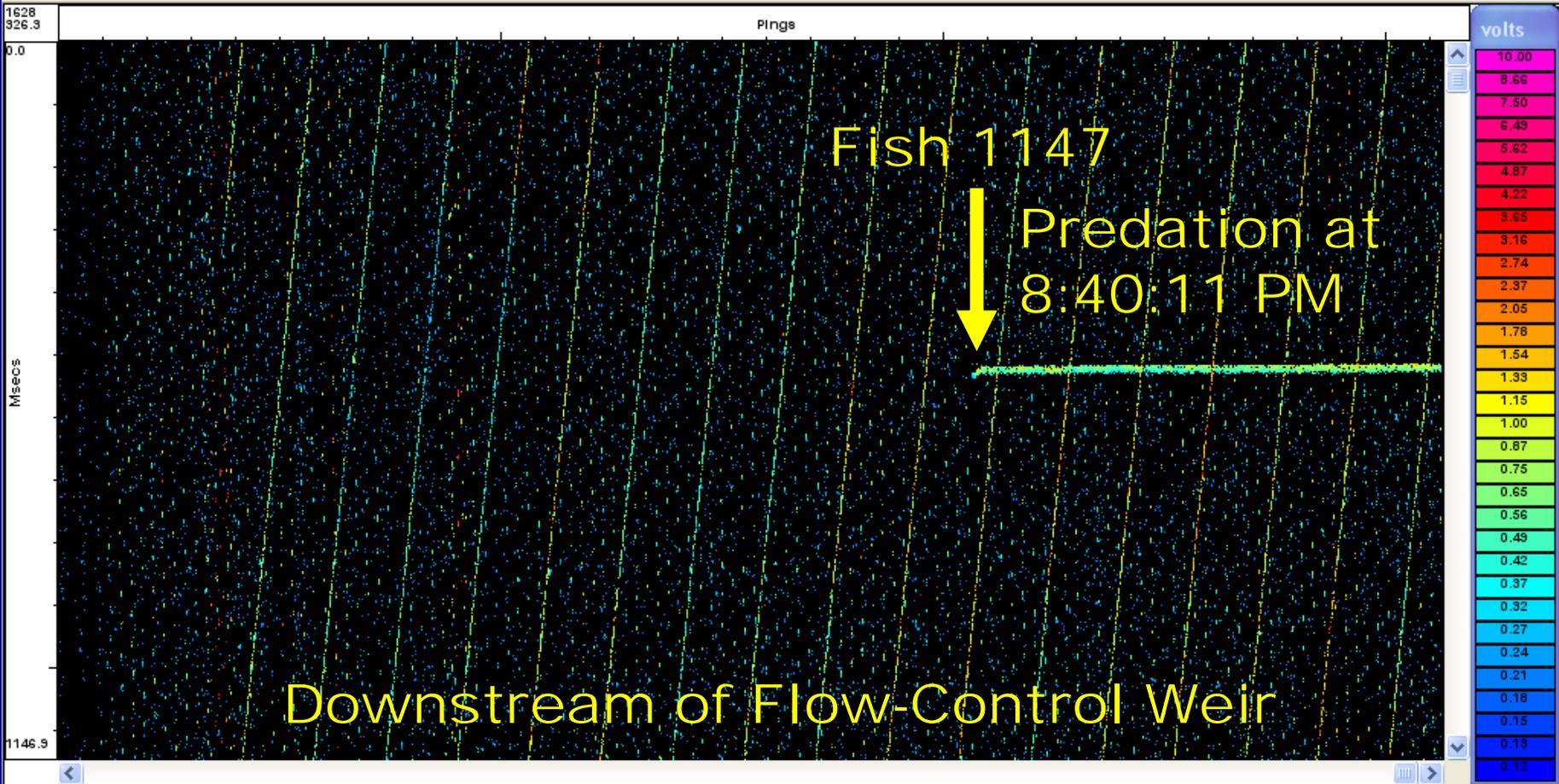


Predation

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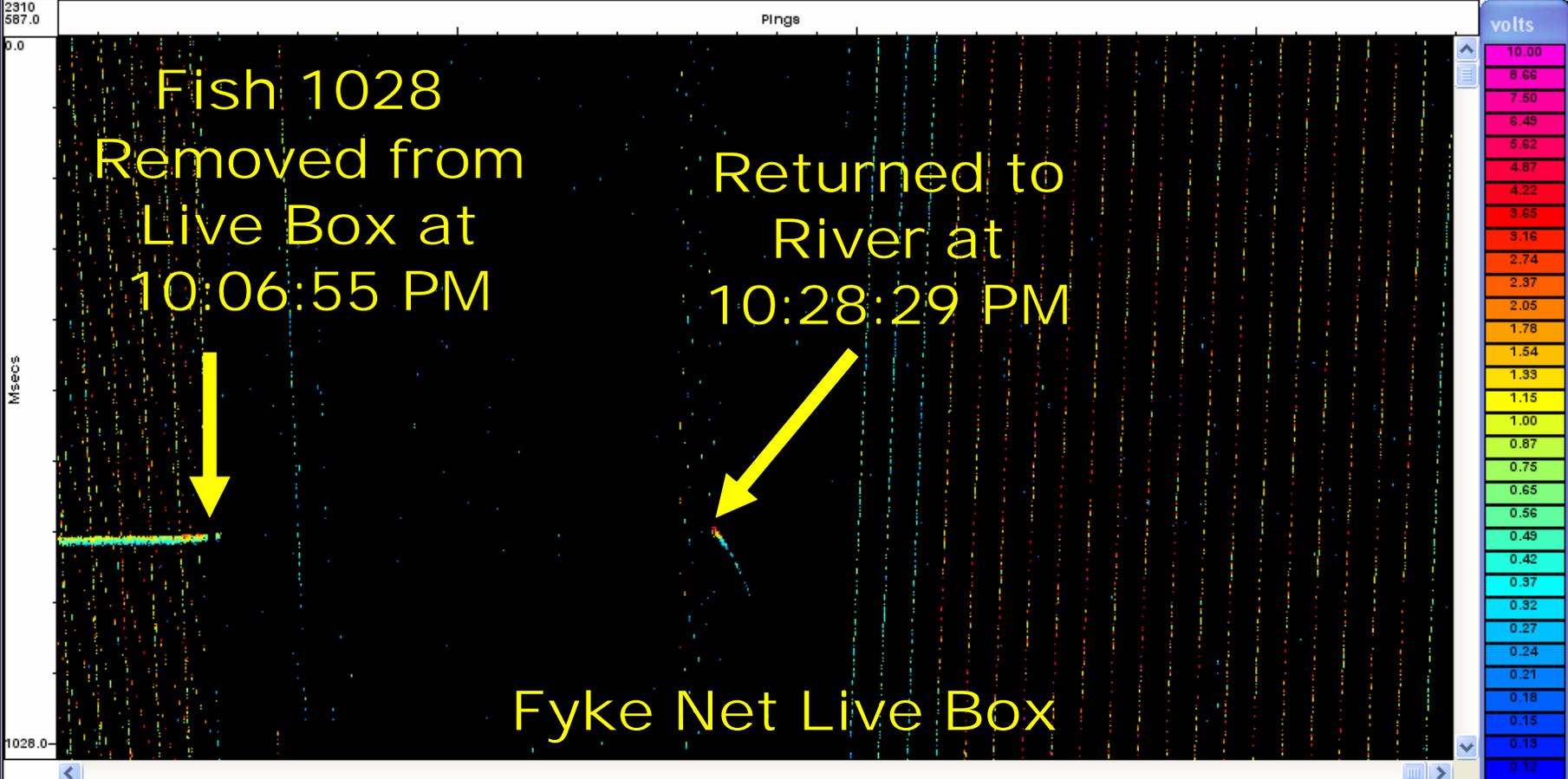
1139.968 All 1140 00 1000,00,R0,76





Fyke Net
Live Box

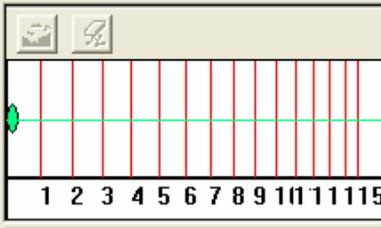
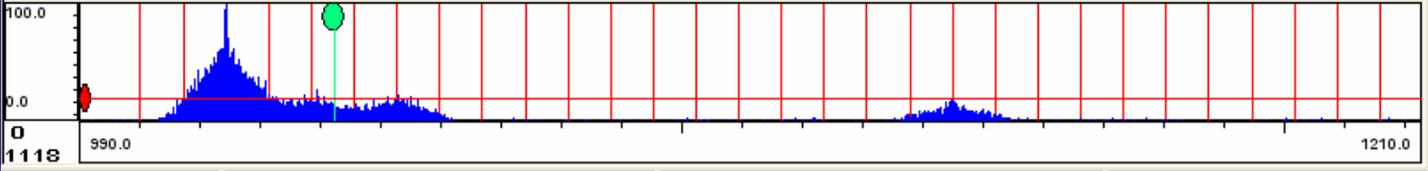


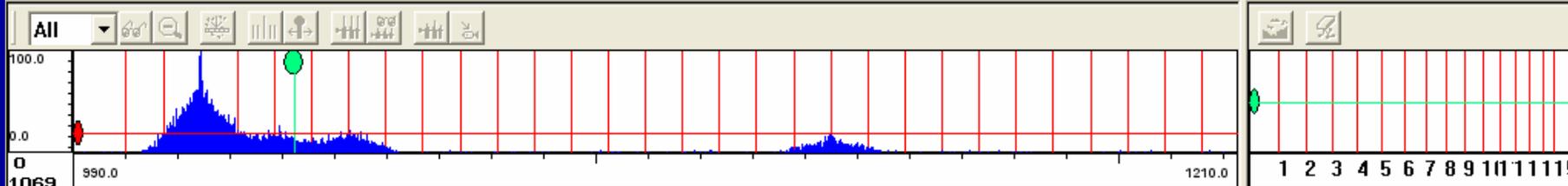
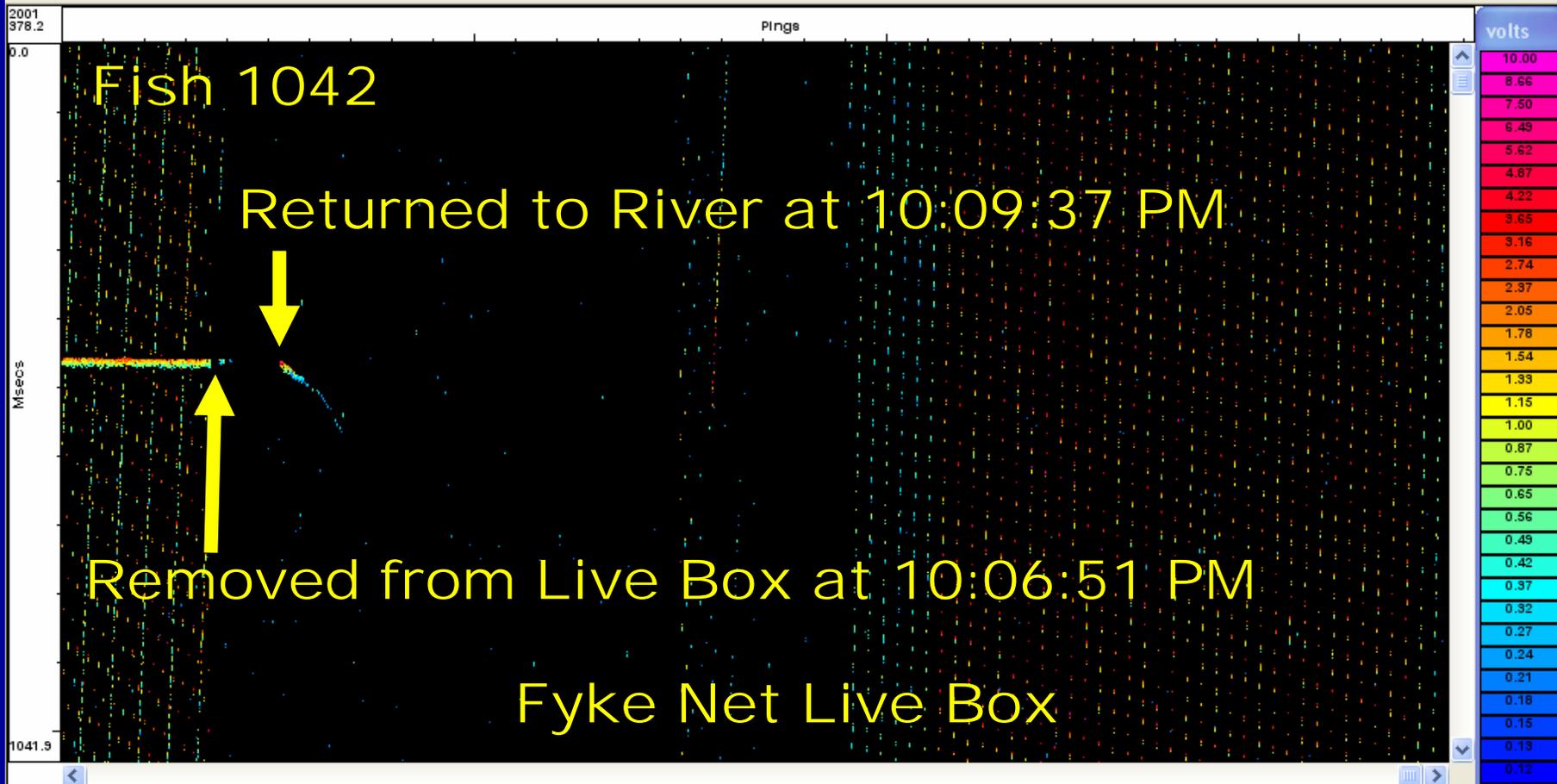


Fish 1028
Removed from
Live Box at
10:06:55 PM

Returned to
River at
10:28:29 PM

Fyke Net Live Box





Advantages

- 1) Smallest acoustic tag available allowing tests using fish < 100 mm (94 mm)
- 2) Tags and equipment can be used for both 3-D positioning to sub-meter accuracy, fixed-station presence/absence, and mobile telemetry
- 3) In-situ fish tag programmer allows fish to recover from surgery, extends tag life, and provides flexibility for field logistics

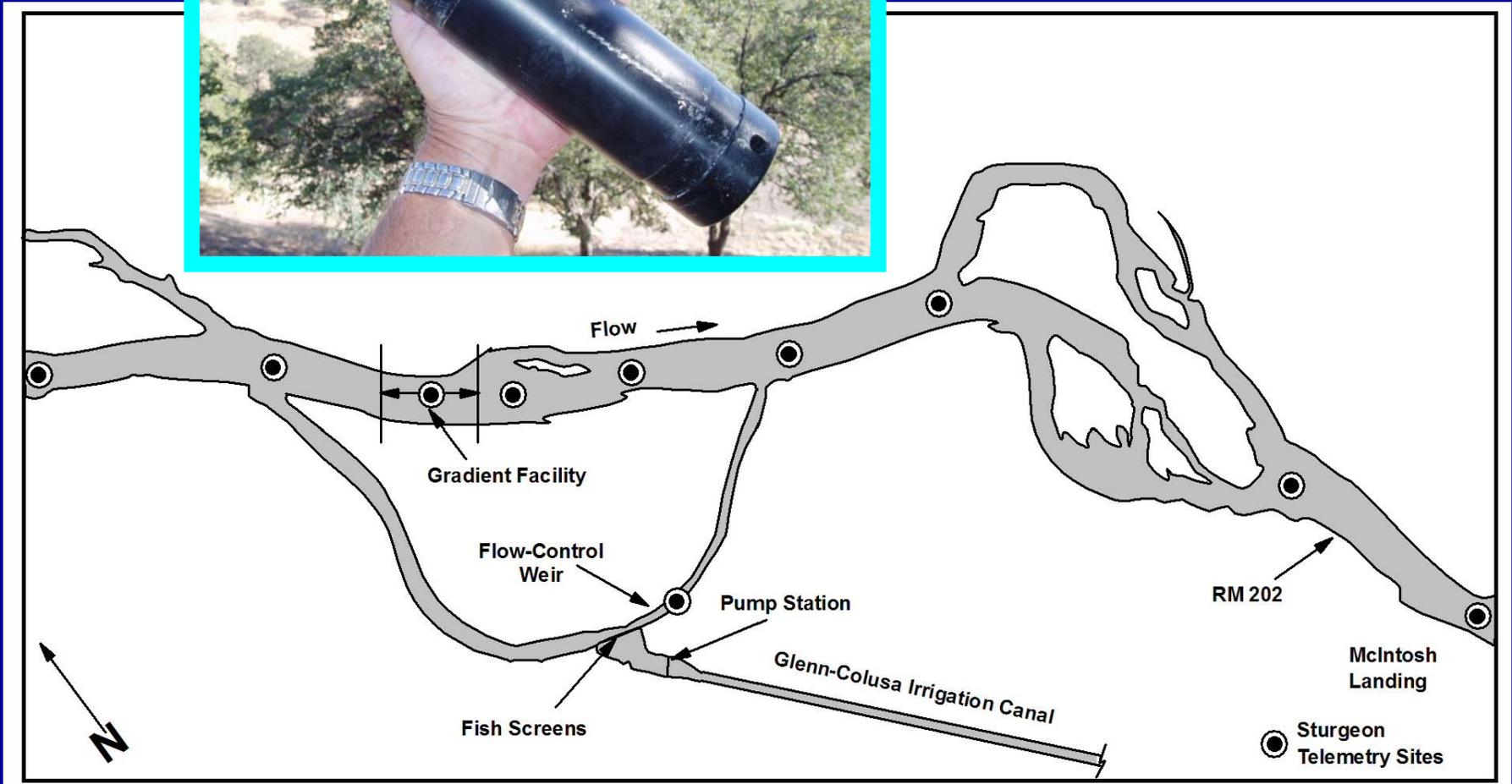
Disadvantages

- Equipment is expensive

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Vemco Receivers



2005 Acoustic Telemetry Sites



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